HISTORICAL PERSPECTIVE

Machine Head: Raoul Hausmann and the Optophone

Jacques Donguy

ABSTRACT

Dadaist Raoul Hausmann, famous for his photomontages, is perhaps less well known as a pioneer of synaesthetic machines designed to transform sound into form and vice versa—not unlike primitive computers, in fact. The author has located the patent for one such invention, artist Peter Keene's realization of which accompanies this historical account.

In his initial text on his invention the Optophone, published in 1922, Dadaist Raoul Hausmann described "space-time" as the sixth and "most important of our senses." (We should recall that Einstein formulated his special theory of relativity, which conceives of time as the fourth dimension of space [1], in 1905, and that the general theory of relativity describes matter as a bend in "space-time"). Hausmann also discussed the "organic relations between the eye and the ear," which he illustrated with photomontages and drawings. In a letter to Henri Chopin dated 23 June 1963, Hausmann wrote:

> I wanted to draw your attention to the fact that I developed the theory of the Optophone, a device for transforming visible forms into sounds and vice versa, back in 1922. I had an English patent, "Device to transform numbers on photoelectric basis," which was a variant of this device and at the same time the first robot. [But] I did not have enough money to build the Optophone [2].

In another undated text about the Optophone, he explained how he developed the idea:

> In 1915 I studied Goethe's theory of color, which shows that Newton's theory of color is erroneous. In 1920 I witnessed the experiment with the incandescent arc speaking lamp at the Berlin Postal Museum, and I became aware of Ernst Ruhmer's experiments on transforming sounds into visible signs using a selenium cell. I still have a copy of his book, dated 1905. I later carried out experiments with prisms. In 1920 I came across an article in an illustrated New York periodical about Thomas Wilfred's Claviluz and colored electrical forms that fly freely in space. I continued my theoretical studies of optics and acoustics and in 1922 I published an article in Russian on the Optophone in Ilia Ehrenburg's journal *Wjescht, Objet, Gegenstand.* The same article was published by Kassak and Moholy in the Hungarian language journal *MA.* In this article, I proved that with its six hundred tubes the eye of the bee is an optophonetic organ. In 1926 Moholy sent me a student of his named Brinkmann, who said I was a real fool not to have taken out a patent for the Optophone. He showed me a letter from Albert Einstein saying that the Optophone was very important.
>
> In 1924 I published technical articles on optophonetics in Hans Richter's journal *G,* and between 1925 and 1932 in Seiwert's *A bis Z,* [based in] Cologne. In 1925 I entered into contact with the German inventors of the talking pictures, Vogt, Masoll and Engel. At the time, I had founded a firm for patents, DIAG, which was officially registered in the trade directory. In the meantime, I had been granted a patent for projection inside corporeal cavities. However, when, after Brinkmann's visit, I requested a patent for the Optophone, the Berlin patents office refused it, saying that it was "technically quite possible, but we cannot see what use it would be."
>
> In July 1931 I published quite a long article about the "Over-Developed Arts" in *Der Gegner,* a journal edited by Franz Jung. In it I showed that the visual arts had reached saturation point and that we needed to develop optophoneticism. In this article I gave a technical explanation of the Optophone. I still have a copy of this issue in my possession.
>
> In 1927 I was visited by the engineer Daniel Broido [3], who was working on a photoelectric calculating machine for a big electricity company in Berlin, AEG. That was when I changed my conception of the Optophone and made it into a variant on the photoelectric calculating machine.
>
> Together, Broido and I built a demonstration model. But the advent of Nazism forced Broido to emigrate to London and me to Prague. In the end I was granted English patent no. 446.338 for the "Device to transform numbers on photoelectric basis." As I was forced to leave Czechoslovakia because of Hitler in 1938, I sold my patent to Broido for 50 pounds sterling [4].

Here are some excerpts from Hausmann's 11-page patent specification (see also Fig. 1):

> PATENT SPECIFICATION
> *Application Date: Sept. 25, 1934. No. 27436/34.*
> *Complete Specification Left: Oct. 25, 1935.*
> *Complete Specification Accepted: April 27, 1936.*
> PROVISIONAL SPECIFICATION
> *Improvements in and relating to Calculating Apparatus.*
> We, Daniel Broido, Engineer, 74 Belsize Park Gardens, London, N.W.8, Nationality: Russian, and Raoul Hausmann, Ibiza, Spain, Nationality: Czechoslovakian [5], do hereby declare the nature of this invention to be as follows:
>
> This invention relates to a device for combining and transmitting a plurality of factors.
>
> Devices are already known which combine a plurality of factors (for instance numbers) mechanically or electrically (for instance multiply them) and transfer the result to a result mechanism. . . .
>
> The present invention relates to a device in which the combination of two or more factors is effected by means of light rays and the result of the combination is also transmitted by light rays by means of a photo-cell to the result mechanism. The object of the present invention consists in the provision of a new device for combining and transferring a plurality of factors, in which optical means are used. The advantage of the in-

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This text is part of the *Leonardo* special project on Synesthesia and Intersenses, guest edited by Jack Ox and Jacques Mandelbrojt. Synesthesia is the phenomenon in which the stimulation of one sense modality gives rise to a sensation in another sense modality; for example, some synesthetes see colors when they hear music. This special project is devoted to the exploration of the nature and history of this phenomenon, as well as the discussion of intersense relationships, artworks and experiences.

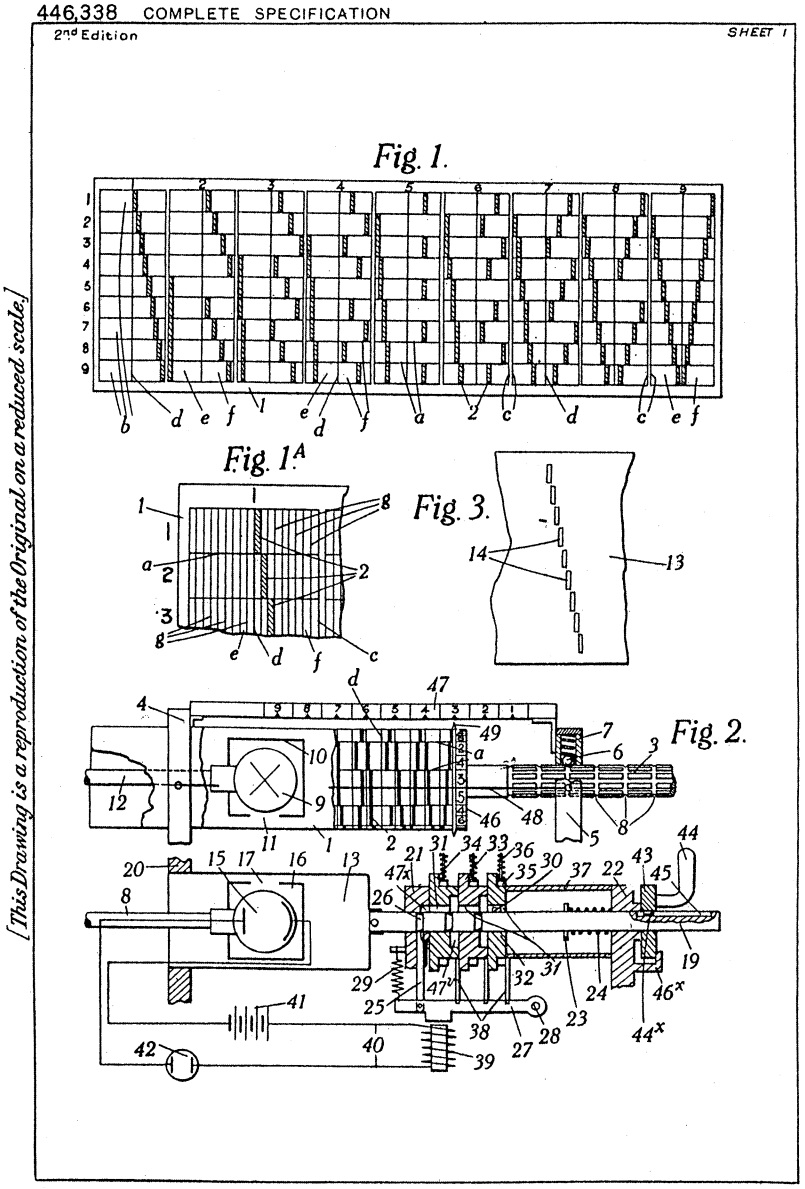
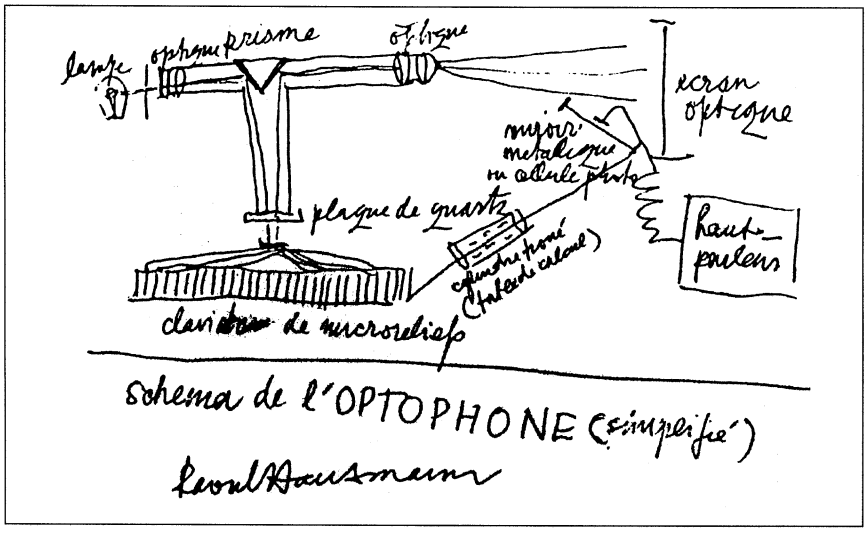


Fig. 1. Raoul Hausmann's drawing accompanying the Optophone patent.

Fig. 2. Hausmann's simplified diagram of the Optophone accompanying the Optophone patent.



vention consists in the extremely simple construction of the device as compared with known devices and machines of this kind, which make use of mechanical or electrical transmitting means and are very complicated in construction. In addition to this the device works extremely rapidly owing to the fact that the photo-cell works without any time-lag. According to the invention the same object is therefore obtained with far simpler and cheaper means.

It may further be mentioned that according to the principle underlying the present invention with a suitable arrangement of the combination fields on the screen and a corresponding selection of a greater number of displacement components (co-ordinates) more than two factors can be combined. Such an arrangement is applicable more particularly for instance to machines for printing railway tickets and the like, in which the three values—destination, class and kind of train—have to be combined.

Dated the 21st day of September, 1934.

—Daniel Broido, Raoul Hausmann [6]

What we have here then is a calculating machine derived from the Optophone. The term "plurality of factors" makes it tempting to think of a computer. The first computer, Enigma, created to decipher German coded messages during World War II, was primarily a calculating machine. One contributor to this project was Allan Turing, the inventor of the Turing Machine, who developed the theory of the computer in 1935 on the basis of Gödel's Theorem. Materially speaking, though, the Optophone was not a computer, because with a computer one can introduce a program that will produce a result with a different structure every time. Hausmann's patent application can be compared to his technical description of the Optophone in the *MA* text on optophonetics:

> If one places a telephone in the circuit of an arc lamp, the arc of light is transformed because of the sound waves that are transformed by the microphone in accordance with variations corresponding exactly to acoustic vibrations, that is to say, the rays of light change form in relation to sound waves.
>
> At the same time, the arc lamp clearly reflects all the different variations from the microphone, i.e. speech, singing, etc.
>
> If one places a selenium cell in front of the arc of light in acoustic movement, it produces different resistances that act on the electrical current in accordance with the degree of lighting. One can thus force the ray of light to produce induction currents and transform them, while the sounds photographed on a film behind the selenium cell appear in lines of varying width or

narrowness, lightness or darkness, and are transformed back into sound by a reversal of the process.

The optophone again transforms images of luminous induction into sounds with the help of the selenium cell using a microphone in the electrical circuit. What appears as an image in the emitter station becomes a sound in the intermediary stations and, if one reverses the procedure, the sounds become images [7].

Later, in a letter to Henri Chopin, Hausmann alludes to a text written in 1960, "Libération de l'imaginaire," which contains a "description of the Optophone":

> If one passes the reflection of different sizes of microscopic rays through a sheet of quartz towards a cylinder with slits like a multiplication table, one obtains reflections of colored light of very varied aspect, because of the dispersion of the rays passing through the slits of the multiplying cylinder. And one obtains on a screen colored phenomena deformed by their angle of reflection. This enables us to trigger an automated process of sequences of variable forms of refracted light and to introduce changes into the ordered visual chains, electrically based systems that are analogues for an imaginary process, analogous to the behavior of electrical discharges [8].

From this period we have Hausmann's simplified diagram of the Optophone (Fig. 2) with the legend: "lamp, lens, prism, sheet of quartz, set of micro-reliefs, slitted cylinder (calculating table), metal mirror or photo cell, speakers, optical screen."

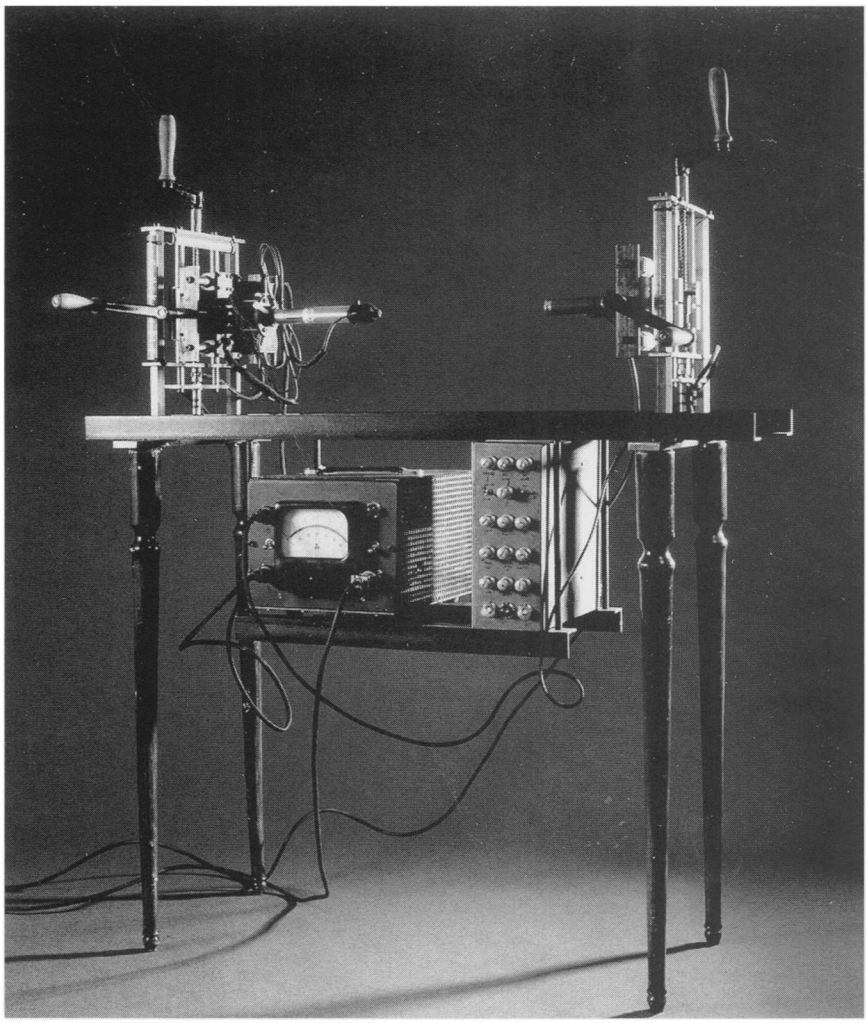


Fig. 3. Peter Keene, *Raoul Hausmann Revisited*, 1999. (© Peter Keene. Photo © B. Kuntz.) Contemporary English artist Keene's reconstruction of the Optophone.

VERBI-VOCO-VISUAL

Peter Keene, an English contemporary artist fascinated with sound, has tried to reconstruct the Optophone on the basis of these elements (Fig. 3). He compared Hausmann's research with that of John Logie Baird, the Scot who created a mechanical television, or "televisor," in 1923, using two Nipkow disks with 30 holes and a selenium cell. It would have been possible to hear the sound produced from the image via a speaker by attaching the selenium cell to an amplifier (the cathode ray tube was not invented until 1934, by the Russian engineer Vladimir Zworykin). Peter Keene recently rebuilt this early television.

Another related invention, in 1924, was the sound-generating machine the theremin, by the Russian engineer Leo Sergejevich Theremin. When attempting to recreate the Optophone, Keene used the mechanical part of Hausmann's patent specifications, with two axes, x and y, a light sensor in the form of a photoelectric cell and a laser ray. The x and y axes correspond to the voltage, on a scale of 0 to 10. But instead of a galvanometer, he used an analog synthesizer, so that a sound, rather than a figure, is obtained.

Today, all this can be done very easily on any old computer. At the beginning of the twentieth century, Raoul Hausmann and Laszlo Moholy-Nagy [9] both dreamed of tools that became available at its end. Perhaps it would be legitimate to write a history of art in terms of technological discoveries. What Hausmann meant by optophoneticism corresponds to the capacity of digital technology to convert text, fixed and moving images and sound into one universal code. In 1985 French artist Gwek Bure-Soh created a "sound camera," an electronic computer device that could produce sounds in real time in relation to the images captured by a video camera. On 5 December 1998, during a performance at the Espace Renaudie in Aubervilliers, north of Paris, the artist managed to sculpt the sound of the audience's voices reading computer print-outs [10], thus bringing to realization what Hausmann had foreseen in a letter to Henri Chopin: "One day I would like to make the Optophone, the only exact electronic device for controlling a new sound system, with considerable independence from human meddling" [11]. This is the aesthetic of what would become the CD-ROM, the creation of what Marshall McLuhan called a "verbi-voco-visual" art [12]. In illustration of this, see the 1997 CD-ROM by *Alire/Doc(k)s* [13], featuring the "Virtual Poetry" of Ladislao Pablo Györi, whose texts break up and reform ad infinitum and in three dimensions, or Augusto de Campos's *Cidade City Cité* [14].

"Where is the new brain, the new organ . . . that will be the first to make us clearly aware of the transformation of the Space-Time World?" This question, posed by Hausmann in 1922, was taken up in

the research of artists such as La Monte Young and Marian Zazeela of the U.S. in the 1960s [15], with their "Dream House" project. Perhaps, at the turn of the next century, we will learn to sidestep the empty debate over post-modernism and, at last, begin to realize what Robert Filliou called "the poet's poor priviledge."

References and Notes

1. From the title of the book by Gilles Tannoudji and Michel Spiro, *La Matière-Espace-Temps, la logique des particules élémentaires* (Paris, Fayard).

2. Raoul Hausmann, letter to Henri Chopin, Archives Henri Chopin (unpublished).

3. Broido was the father of Vera Broido, Hausmann's model and partner from 1928 to 1934.

4. Raoul Hausmann, letter to Henri Chopin, in Archives [2].

5. "I was a Czech citizen up to 1946 but because of their law on 'national descent' I was stripped of my nationality since I was born in Vienna and my father's family only settled in Czechoslovakia in 1809." In Théodore Koenig, *72 lettres de Raoul Hausmann* (Illasi, Italy: Laser Edition, 1990).

6. "Apparatus for the ©eneration of Sounds," United States Patent Office, no. 1 661 058.

7. Quoted in Jean-François Bory, *Raoul Hausmann* (Paris: Editions del'Herne, 1972).

8. Raoul Hausmann, letter to Henri Chopin˜, in Archives [2], 10 October 1963; text printed without date in *Raoul Hausmann,* exh. cat., Musée d'Art Moderne de Saint-Etienne and Musée Départemental de Rochechouart, 1994.

9. Arthur Pétronio tells how Moholy-Nagy tried to provoke acoustic phenomena independent of the recording by altering the grooves on the record so as to obtain "new sounds and mixes of timbres." This was all very laborious, of course, compared to what can now be done with a computer.

10. This event was part of a show by the pH 7.35 group, repeated at the Pompidou Center's "Revue Parlée" on 6 January 1999. Since 1983 I have been working with Guillaume Loizillon on poetic texts indefinitely reprocessed on computer using random procedures.

11. Raoul Hausmann, letter to Henri Chopin, 20 December 1963, in Archives [2].

12. See Marshall McLuhan, "Verbi-voco-visual Explorations," reprinted by Dick Higgins (Something Else Press, 1967).

13. Joint publication by the journals *Alire,* No. 10 (1997)/*Doc(k)s* **3**, Nos. 13–16 (1997).

14. Gyõri is creator of a multimedia show, "Poesia é risco," seen at Paris's Cité de la Musique, May 1999, and published by Polygram on CD (No. 5 26 508-2).

15. An example was the exhibition "Musiques en scène," at the Musée d'Art Contemporain de Lyon, 12 February–11 April 1999.

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